

**DRAFT Request For Information letter**

CERTIFIED MAIL  
RETURN RECEIPT REQUESTED

April 6, 2015~~January 19, 2012~~

Michael McPhie  
President and Chief Executive Officer  
Curis Resources (Arizona) Inc.  
1575 W. Hunt Highway  
Florence, AZ 85132

**RE: Request for Information (RFI)  
Class III Underground Injection Control (UIC) Well Permit Application  
Curis Resources (Arizona) Inc.**

Dear Mr. McPhie,

The United States Environmental Protection Agency, Region IX (EPA) is conducting a technical review of your application for a UIC Class III Area permit for the subject site at 1575 W. Hunt Highway in Florence, Arizona. In order to continue our evaluation of your application, we are requesting additional information and clarifications as detailed in the enclosure.

Please address all items noted in the enclosure by submitting supplemental information in hard copy (2 copies) and in electronic format. With a complete response to this request, we will be able to continue our technical review of your application. We also reserve the right to require additional information from Curis Arizona during the technical review phase, if necessary. Please provide your supplemental information within 45 days of the date of this letter.

Please submit the information requested in this letter to:

Nancy Rumrill  
U.S. EPA Region 9, (WTR-9)  
75 Hawthorne Street  
San Francisco, CA 94105

If you have any questions regarding this letter, please contact me at 415-972-3971 or call Nancy Rumrill of my staff at 415-972-3293.

Sincerely,

David Albright  
Manager, Ground Water Office

Enclosure

cc w/ enc: Richard Mendolia, Arizona Department of Environmental Quality (ADEQ)  
Dan Johnson, Environment & Technical Services Manager, Curis Arizona

**Request for Information**  
**Curis Arizona's UIC Permit Application**  
**April 6, 2015~~January 19, 2012~~**

**Financial Assurance**

1. The existing UIC permit states that the permittee shall maintain an investment grade bond rating of BBB or Baa or higher for the financial responsibility demonstration, or post a financial instrument such as a bond, letter of credit, or trust fund to guarantee closure if the most recent bond rating falls below those ratings. EPA does not consider that provision, nor the applicant's proposed insurance policy to be sufficient to demonstrate long-term financial assurance. Please submit revised information regarding the financial mechanism(s), such as a bond, letter of credit, and/or trust fund, that Curis Arizona intends to utilize for each point in the development of the In Situ Copper Recovery (ISCR) wells, closure, restoration, and post-closure. Please see the financial assurance requirements outlined in 40 CFR §144.63. EPA will consider the submitted closure plans and the third-party estimates to evaluate the specific amounts of financial assurance adequate for each part of the operation and closure.

**Plugging and Abandonment**

2. The Application states that non-Class III wells will be properly plugged and abandoned prior to commencement of ISCR operations within 500 feet of these wells, with the exception of point-of-compliance (POC) wells and other monitoring wells. Identify the other monitoring wells included in the exception. For instance, if these monitoring wells are listed in Table C-2, identify them from the table. Please provide cementing records, if available, for these wells and for any other non-Class III wells that may be plugged and abandoned as covered in the corrective action plan to determine whether remedial cementing may be required to isolate Underground Sources of Drinking Water (USDWs) from the injection zone in those wells. Provide also, if available, the relevant lithologic and geophysical logs and/or geological contact depths for those wells to facilitate that determination.
3. Notification and reporting requirements for plugging and abandonment (P&A) of the non-Class III wells and coreholes subject to the corrective action requirements at 40 CFR Part 144.55 are not specified. P&A reports for non-Class III wells and coreholes located within the area of review (AOR) are necessary to ensure compliance with the corrective action plan. Please provide a revision of the submitted plan to include a process for notification and reporting of P&A procedures and operations to EPA, as well as ADEQ or other appropriate regulatory agencies.
4. In the proposed P&A procedures described in Attachment Q, it is stated that if "cascading water" is encountered during preparation for abandonment, the casing in the target area will be perforated, isolated with cement plugs, and Type V cement will be used to seal the annulus around the perched layer. Please explain what is meant by "cascading water." The description of the procedure for isolating a perched layer is also

unclear. Please provide clarification by means of a schematic diagram of the well and a description of the cementing procedure.

### **Closure/Post-Closure Plans and Cost Estimates**

5. The Phase 1 closure cost estimates for groundwater restoration are \$1,026,470, based on the estimated cost of pumping adequate volumes of rinse water to restore groundwater, assuming eight percent porosity and three pore volumes are required. Restoration is assumed to take approximately 12 months to complete. The duration of restoration would take longer if the average of 13 percent porosity (as determined from density logs run in three of the wells) is used in the calculation and if more than three pore volumes are required for complete restoration. Appendix F of the existing UIC permit contains the Closure and Post-Closure Plan and states that the *“production recovery wells will be operated for a period of time until 4 to 10 pore volumes are taken from the wells.”* That would indicate a much higher cost for groundwater restoration. Please explain the basis for the assumed eight percent porosity and for the estimated three pore volumes required for complete restoration.
6. The Phase 2 closure cost estimates for groundwater restoration are listed in Table 3.3 of the Aquifer Protection Permit (APP) application. The groundwater restoration costs are estimated at \$26,138,868 plus contingency and administrative costs of 25 percent for a total of \$32,673,585. Those estimates are based on an average orebody porosity of eight percent and the assumption that restoration can be completed in 24 months with recovery of three pore volumes. Those assumptions are in question for the same reasons as discussed above regarding Phase 1 closure costs. Please provide a justification for the porosity and pore volumes used in the determination of the length of time to complete the restoration.
7. The post-closure cost estimate includes the cost incurred to correct one exceedance event over the 30-year monitoring period, which is \$10,000. Please provide a justification for assuming one exceedance and for how the cost of \$10,000 to mitigate the exceedance was determined. Include why additional exceedances were not considered and an itemized break down of the estimated mitigation costs.
8. The APP application, Section 16.2.3, states that Phase 2 operations will include installation of *approximately 200 injection wells and 250 recovery wells in each operational unit, plus four pairs of recovery and observation wells along the perimeter of the operational unit for maintaining and monitoring hydraulic control.* Those numbers are inconsistent with the discussion of numbers of wells in each operational unit at Section 16.2.4 and other sections of the UIC and APP applications, including the estimated 600 injection and recovery wells to be closed in the last commercial operational unit. Also, Attachment R of the UIC application, Necessary Resources, indicates that the number of wells to be abandoned in each operational unit will be 597 ISCR wells plus five observation wells. Please provide clarification of the number and type of wells to accurately reflect the number in each operational unit and the last operational unit.

9. The APP application, Section 16.2.4, describes Phase 2 closure operations as follows: *It is assumed that Phase 2 closure will begin when copper concentrations in the pregnant leach solution (PLS) pumped from the last operational unit(s) in the ISCR area decline to levels that can no longer be economically recovered. Phase 2 closure only includes the final operational units as previously operated units will be closed concurrent with operations. Phase 2 closure is assumed to include closure of operational units that will be in operation or in various stages of closure when final closure begins.* Please clarify what is meant by the reference to final closure in the preceding sentence as it relates to Phase 2 closure operations. Include clarification in your post-closure plans that the 31 POC wells will be the last for P&A after the wells are no longer needed at the conclusion of the post-closure monitoring period.
10. Please provide clarification that the closure cost estimate includes the representative number of units in various stages of closure when final closure of operational units begin, as described in the previous paragraph. Provide also clarification that the post-closure cost estimate includes the final POC wells as described in the previous paragraph. Revise the cost estimates accordingly.
11. The Overview of ISCR Operations described on page 3 in Attachment Q of the UIC application states that “[n]ot more than two years following the provisional closure of a resource block, all wells and coreholes within the block will be abandoned in accordance with the procedures outlined in this plan.” Please delete “and coreholes” or clarify that statement because the coreholes would have been abandoned as part of the corrective action plan.
12. The proposed amendment deletes reference to the 30-year duration of the post-closure monitoring period. That duration is part of the basis for approval of the original permit and the post-closure monitoring cost estimates. It has also been deleted under Part II.K, Duration of Permit. Please provide an explanation for the deletion. Provide also a justification for a different term of post closure monitoring on which your cost estimate is based and a description of how the post closure monitoring duration affects the post closure cost estimate.
13. Although EPA is aware that the applicant is planning to submit a revised design for the Production Test Facility (PTF) wells, we are considering the existing submittal until the details of the new design has been submitted by Curis Arizona. Therefore, the proposed amendments submitted by the applicant expand on the description of the procedure for cementing the fiberglass reinforced plastic (FRP) casing and indicate that a *tremie pipe* will be used to fill the annular space between the borehole and the casing from the bottom of the exclusion zone to the surface. Provisions for using PVC pipe as casing above the injection zone and cementing procedures for PVC casing were deleted. This language appears consistent with the intent of the existing permit, except for the option to use a tremie pipe to place cement in the casing annulus. Apparently, the use of a tremie pipe, rather than displacement of cement down the casing, may be used when well screens and filter packs are installed in the well. Please clarify the basis for that change and under what circumstances it would apply. Attachment L of the UIC application states that in

wells “constructed without well screen and filter pack, cementing may be accomplished by pumping cement down the well casing and up the annulus prior to drilling below the bottom of the exclusion zone.”

### **Proposed Operations**

14. Please provide figures that show the proposed well field layout of a typical resource block and an operational unit, including injection, recovery, observation, and monitoring well locations within the block and unit.
15. Please summarize those elements in Attachments H, K, O, and P of the application that describe the proposed operations in a stand-alone Operations Plan. This Operations Plan may be incorporated into the proposed permit's Appendix.

### **Groundwater Flow and Transport Modeling**

16. Faults were apparently simulated in the MODFLOW model, but we found no discussion on how that was done. Also, we found little discussion of how the aquifer test results were applied in the groundwater flow model. Please explain how these aspects are considered in the model. Include in your explanation a description of the geometry (i.e., length, size, thickness, and orientation) of the faults used in the model.
17. The MODFLOW simulation of fluid movement in the oxide zone assumes constant porosities and hydraulic conductivity in each of the five layers that represent the oxide bedrock zone, without consideration of lateral variation due to fault and fracture orientation. That variation should be taken into account in the model so that calculations of the injectate front location better reflect the anisotropy of the oxide injection zone. Fluid movement along faults is apparently simulated as one vertical layer of the model, but the calculation of the average porosity and hydraulic conductivity (K) values of 10 percent and 2.51 feet per day (ft/day) and a description of how they were applied in the simulation were not found in the application materials. The calculation of average porosity and K values in the other layers was also not found in the application materials. Please provide an explanation of how the average porosity and K values were determined and the rationale for assigning the average porosities and the horizontal K values for the model layers.
18. The APP application anticipates an excess withdrawal rate of 3 percent (330 gpm), as stated in Section 10.3.3 on page 7 of the APP application, while the UIC application assumes a 6 percent (660 gpm) excess withdrawal rate during Phase 2 commercial operation, as stated in Section N.4 on page 4 of the UIC application. During Phase 1 operations, the anticipated rate is from 3 to 10 percent, as stated in Section 10.3.3 on page 7 in the APP application. Phase 1 PTF operations assumes a 20 percent excess withdrawal rate as stated in Section K.3.1 on page 5 in Attachment K of the UIC application. The groundwater model was run at 10 percent (1100 gpm). Run the model at 3 percent and/or 6 percent, whichever is applicable for Phase 2 operations. Please provide the model run results in electronic file format, and provide a description of the

data input and the associated results. Please provide an analysis of these results as to how it affects hydraulic control operations and the extent of its effect on the AOR determination.

19. On page 48, the Golder Associates Report (Analytical Interpretation of Hydraulic Tests at the Florence Mine Site, dated February 12, 1996) states that the presence of fault zones and associated fracture networks increases the effective conductivity of the oxide zone to about 40 ft/day over a length scale of about 3,000 feet (Cluster 28 wells). The Golder Report goes on to state that “[t]his value is based on the observations in a single cluster of wells and needs further verification with carefully planned tests”. The model assumes a hydraulic conductivity of 2.51 ft/day in a fault zone of unspecified length. We recommend that the model be run with a fault zone conductivity of 40 ft/day over a 3,000 foot length to model a worst case scenario. The model run results should be provided in electronic file format and should include a description of the data input and the associated results. Please assess how these results compare to your initial model simulation runs based on the input parameters and assumptions. Include in your assessment to what extent this result might affect hydraulic control, vertical migration and the AOR determination.
20. Run the model with an average porosity value of 13 percent applied to the upper three layers (6, 7, and 8) of the oxide zone and 20 percent in the fault zone. These parameters are based on our analyses of density log responses in three wells. Please provide the model run results in electronic file format, and provide a description of the data input and the associated results. Assess how these results compare to your initial model runs in the UIC application.
21. Since the Middle Fine-Grained Unit (MFGU) is thin or missing in parts of the ISCR area, we recommend running the model without layer 3 in those areas where the MFGU is less than 10 feet thick or absent. Cross section F-F’ in the Site Characterization Report (Exhibit I-1 in the UIC application) indicates it is missing altogether over a 1350-foot section in the northern portion of the ISCR area. Cross Section F-F’ is equivalent to Cross Section B-B’ presented in the UIC application; however, the latter does not show the MFGU missing as presented in Cross Section F-F’. Construct and provide an isopach contour map of the MFGU, and use that as a basis for modeling vertical groundwater flow within the ISCR area. Please provide the model results in electronic file format, and provide a description of the data input and the associated results. Provide a comparison of these results to the initial model results taking into account the potential for vertical fluid migration from normal operations.
22. In areas of the ISCR where porosity is at a minimum of two percent and the thickness of the oxide zone layer is at a minimum of 15 feet, fluid migration during an excursion event could far exceed the 90 to 140- foot distance calculated by the Applicant. We recommend that you configure and run the model under those assumptions to assess the worst case scenario. Please provide the model results in electronic file format, and provide a description of the data input and the associated results. Compare these results to the initial model runs in the application.

23. If hydraulic control is not restored within 48 hours and goes undetected for an indefinite time, eventually an observation well should encounter a lower than expected head and an increase in the measured constituents in groundwater samples. The length of time for that to occur is unknown. Perform a sensitivity analyses with the model under reasonable assumptions of duration, such as 96 hours, 10 days, and 30 days, to estimate the distance of fluid travel in those time frames. Run the model with the parameters for porosity, hydraulic conductivity, and fault length that we have indicated in the previous paragraphs. Please provide the model results in electronic file format, and provide a description of the data input and the associated results.